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Debt Concentration and Secondary Market Prices

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and
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The more concentrated the debt holdings in large money center banks, the higher the secondary price of that debt.

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Using a model that distinguishes between large money center banks and smaller regional banks, Fernandez and Ozler show that the percentage of a country's debt held by the large banks affects the secondary market price of that country's debt: the higher the concentration of the debt, the higher the secondary market price.

They also show that if debt is freely traded in the secondary market, the entire stock of debt

will not eventually end up being owned by the large banks.

Their empirical analysis incorporates several potential determinants of secondary market prices: variables associated with a country's economic performance, variables that can be associated with the creditor country's regulatory structure, and the concentration of debt in the hands of the largest U.S. banks.

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by
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and
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1. Introduction

In the ongoing debate as to what should and/or can be done about the scale of developing country debt, secondary market prices for government and government guaranteed debt are often referred to as indicators of the value of the outstanding debt of these countries. These prices show a wide variety of sizable discounts (to give but two examples, the debt of Peru trades at 4 cents on the dollar and the debt of Chile trades at 64 cents on the dollar (July 1989)), clearly suggesting skepticism that these loans will ever be fully repaid. Since the secondary market price of a country's debt is thought to reflect its repayment prospects, an important step for judging the merits of any plan to deal with the debt crisis is to identify the factors that affect those prospects. These factors are typically conceived as being features associated with the country's economic performance (e.g. GNP, exports, etc.). By way of contrast, here we argue that certain characteristics of a country's creditors will also influence a country's repayment prospects, and hence secondary market prices. In particular, we focus on the role that the degree of concentration of a country's debt in the hands of large international banks plays in determining the secondary market price of that debt.

We develop a theoretical model that distinguishes between two types of banks: large money center banks and smaller regional banks. We show that the percentage of a country's debt held by the large banks affects the secondary market price of that country's debt: the greater the degree of concentration, the higher the secondary market price. Our empirical investigation

demonstrates that concentration indeed has a positive effect on secondary market prices.

The theoretical model assumes that the debt renegotiation process possesses three fundamental characteristics: (i) the country's motivation to repay its debt is its fear of being penalized by its creditors, (ii) penalizing the country is costly for the banks, and (iii) although the amount repaid by the country is shared pro rata by all banks, the large banks face a greater than pro rata cost in penalizing the country due to the damage that the penalties inflict on their extensive business interests with these countries. We show that the most favorable subgame-perfect equilibrium for the banks has the country repaying an amount that is an increasing function of the proportion of the debt owned by the large banks. As modeled, the value of the debt increases as the percentage of the debt owned by the large banks increases. We construct a model of the secondary market to show, however, that this does not necessarily imply that the large banks will end up owning the entire stock of debt. The free-rider problem, evident when it comes to discussions of debt forgiveness and new money contributions, also plays a critical role here. A small bank has an incentive to hold out and thereby obtain the return to ownership of a unit of debt whose value will have increased in accordance with the greater portion of the total debt owned by the large banks. Since each small bank has the same incentive, we show that in equilibrium no debt will be bought by the large banks from the small ones in the secondary market.

We conduct an empirical analysis of secondary market prices to determine how these are affected by debt concentration. Our measure of the degree of concentration is calculated as the ratio of exposure of the nine largest US

banks to the exposure of all US banks that are not in the largest 24 (largeness is defined by asset size). Quarterly data over the 1986-1988 period for 43 countries is employed. In addition to a measure of concentration, two other types of variables are considered as possible determinants of secondary market prices: A first set of variables include borrower country characteristics that may function as indicators of a country's repayment prospects, such as debt ratios and GNP per capita. Second, bank exposure to countries and bank capital aggregates--variables that may reflect regulatory features of the creditor's country--are also considered.

Employing a Tobit model we find that the degree to which a country's debt is concentrated is an important and statistically significant determinant of the secondary market price of that debt. Specifically, a higher debt concentration is found to imply a higher secondary market price. Our estimations suggest that as concentration is doubled from its sample mean of 5 to 10, secondary market prices show an increase of 7 cents to 30 cents on the dollar from their sample mean of 48.

Our finding of a positive effect of debt concentration on secondary market prices has a number of important implications for policy making and theoretical debates. The first lesson is that secondary market prices are not influenced solely by the "good" or "bad" behavior of the debtor countries. The degree of debt concentration is a feature that characterizes creditors: the structure of the banking system, the regulatory systems in the lender countries, and optimal portfolio considerations are among the factors that might lead to a particular distribution of the debt among banks in the initial syndication of a loan. The contribution of each of these factors to debt

concentration, and hence to secondary market prices, should be taken into account when assessing the value of debt forgiveness programs, debt-equity swaps, and virtually any other scheme that relies on secondary market prices. Secondly, the role that differing characteristics among creditor banks may play in any negotiation--in our case, the asymmetry in the extent of banks involvement, exclusive of debt, with these countries--is an important feature that has been neglected, in most part, by the theoretical and empirical literature. Lastly, the (theoretical) presence of free-rider problems in our model of the secondary debt market indicates, once again, that there may be important room for coordinated responses to the debt crisis.

Our paper is organized as follows. Section 2 develops the main bargaining model between the creditor banks and the debtor country. Section 3 presents a very simplified model of the secondary debt market. Section 4 consists of an empirical investigation of secondary market pricing behavior, and Section 5 concludes.

2. A Model of Sovereign-Debt Renegotiation

Over the past decade the question as to why debtor countries repay any of their debts has received much attention. As is well recognized, there must exist either some benefit from repayment or some cost from repudiation in order to support positive lending to sovereign countries. To name but a few examples, Eaton and Gersovitz (1981), Eaton (1989), Bulow and Rogoff (1989b), and Rosenthal (1990) have examined the role of reputation in sustaining loans (where default is taken to imply the exclusion from credit markets in the future), Fernandez and Rosenthal (1990) the role of benefits from repayment,

and Bulow and Rogoff (1989a), Fernandez and Glazer (1990), and Fernandez (1990) the effects of penalties more generally.

Our principal interest here is to develop a penalty based model of sovereign-debt renegotiations that is able to provide an explanation for why the secondary market price of a country's debt and the concentration of this debt in the hands of the top US banks is positively correlated. Our explanation centers on two characterizations that we make of sovereign-debt renegotiations. First, that penalizing a defaulting country is costly to the banks and, second, that there is an important asymmetry between the large established international banks and the smaller creditor banks.

We construct a sequential bargaining model (a la Rubinstein (1982)) between the debtor country and the "large" banks component of its creditors. The banks are assumed to possess the ability to punish a country that does not repay its renegotiated debt.¹ Our model (a variant of Fernandez (1990)) differs, however, in a critical aspect from the other sequential bargaining models that rely on penalties. In, for example, Bulow and Rogoff (1989a) banks always have an incentive to penalize a defaulting country (by seizing some portion of its traded output), since they obtain an immediate net benefit from doing so, namely a certain percentage of the country's traded output.² In Fernandez (1990), by contrast, there are equilibria in which the banks never penalize the country since to do so is costly and does not guarantee eventual repayment. The economics that underlies these two different modelling strategies concerns the nature of the punishments which banks can

¹They cannot, however, precommit to punishment.

²Bulow and Rogoff suggest that their results can also be extended to costly punishments though implicit in their argument is that banks can commit to bearing small costs.

apply. If these penalties consist primarily of the seizure of traded goods which can be immediately translated into a net benefit for the banks (independently of whether or not the country repays), then the Bulow and Rogoff type model of debt renegotiation is best able to capture this. If, however, penalties cannot be committed to and primarily consist of the negation of trade credits and/or sanctions applied by the creditor countries' government (or even exclusion from all future credit markets), in other words, penalties whose distinguishing feature is that they do not, in and of themselves, provide a net benefit to creditors, then a model of costly penalties is more appropriate. We choose to work with the latter conceptualization of the penalty structure.

Our second critical distinction is that between large international banks and smaller, primarily domestic, banks. The analyses of sovereign-debt renegotiations mentioned previously have, by and large, abstracted from any differentiation among the creditor banks (an exception is Fernandez and Kaaret (1988)) although, of course, free rider problems have received some attention (e.g. Krugman (1988) and Sachs (1983)). Rescheduling, however, is an extremely complicated process involving hundreds of banks and loans of various terms and maturities. Negotiation typically takes place between the debtor country and a creditor committee consisting of a small group of very large international banks (e.g. Citibank, Chemical Bank, Manufacturers Hanover, etc.). What distinguishes these banks, aside from sheer size, is the nature of their relationship with the debtor countries. These banks provide services to their domestic customers to enable trade between them and the country. They often have branches in these countries and a considerable portion of their profits is derived from other business with these countries and their

customers. The small banks, on the other hand, only entered the international arena temporarily in the credit boom of the seventies and do not otherwise have extensive links with the debtor countries. Consequently, any action taken to punish the country is bound to be more costly for the large international banks than for the small banks. We now turn to a more formal description of the model.

We consider the following situation. Two parties, one consisting of the large creditor banks (which we will henceforth call the large bank, B, and assume that it acts as one agent, ignoring any problems which may exist within this coalition), and the other consisting of the debtor country, are engaged in negotiating over how much of its debt the country must repay. In order to simplify an already quite complex problem, we will consider repayment of the debt to be once and for all and not over a number of periods.³ Bargaining takes place over discrete time $t \in \{1, 2, \dots\}$. In every odd period the large bank offers a debt settlement x_t , $0 \leq x_t \leq D$ which specifies the amount that the banks are asking to be repaid. $D > 0$ is the amount of the country's outstanding debt. The country (C) then responds by either accepting the offer (Y) or rejecting it (N). If the country accepts the offer, negotiations are over. The country then pays the banks x_t and the remainder of the debt, $D - x_t$, is forgiven. If the country rejects the offer, the large bank must then make a decision as to the level of punishment $p_t \geq 0$, to inflict on the country that period. After the country is punished (the punishment can be zero), time advances one period.

³Bulow and Rogoff (1989a) deal with this problem by imposing conditions on the discount factors of the two parties and specifying a time horizon after which all production in the country ceases.

In every even period it is the country's turn to make a debt settlement offer y_t , specifying the amount that the country is willing to repay. The banks then respond by either accepting (Y) or rejecting (N) the offer. Once again, an acceptance indicates the end of negotiations and the country pays the banks y_t , the latter forgiving the remainder $D - y_t$. A rejection leaves the banks with a punishment decision to be made in that period, p_t . After the country is punished, time advances one period. This game can continue for a potentially infinite number of periods. See Figure 1 for the extensive form of this game.

It is costly for the large banks to punish the country. This cost $c = c(p)$ is assumed to be an increasing, continuous, convex function of the punishment level with $c'(0) = 0$ and $c'(\infty) = \infty$ and is incurred in each period in which a penalty is applied. Thus, in the same period that the large banks are choosing a punishment level, they are also choosing the level of the costs that they themselves will bear that period. These costs can be thought of as lobbying costs (incurred in order to persuade Congress and other interested parties to accept harming certain domestic constituencies, such as exporters to the country, when punishing the debtor) and costs to the operations of the banks within that country and to the profits derived from their servicing of domestic clients (who use these banks as intermediaries to do business with the country). This is where the asymmetry between the large creditor banks and the many small banks takes its bite. Although both large and small banks share pro rata in any repayment by the country, the costs incurred in punishing the country are not shared pro rata. Although debt contracts require some costs to be shared pro rata (court expenses, for example), the large banks will find it much more costly to disturb their normal operations

with the debtor countries than the small banks. These costs are not written into the debt contract. For simplicity, we assume that this asymmetry between large and small creditor banks is such that the large banks bear all the costs of punishing the defaulting country.⁴ Hence, if the large banks are able to obtain a payment of Z from the country and α is the fraction of that country's debt owned by the large banks, then αZ is the payment received by the large banks. Any cost incurred in obtaining this payment, however, is borne in its entirety by the large banks.

We now turn to a discussion of each party's payoff. The large bank is assumed to maximize the discounted value of its share of the country's payment net of the cost it incurs in punishing the latter. The large bank's payoff from a settlement z reached in period T is

$$- \sum_{t=1}^{T-1} \delta_b^{t-1} c(p_t) + \alpha \delta_b^{T-1} z \quad (1)$$

where $0 < \delta_b < 1$ is the banks' common discount factor.

The country attempts to minimize the discounted value of its punishments and payment. Consequently, its payoff from a settlement z in period T is

$$- \sum_{t=1}^{T-1} \delta_c^{t-1} p_t - \delta_c^{T-1} z \quad (2)$$

⁴What is essential is that the large banks' share of the costs be greater than their share of the country's repayment.

where $0 < \delta_c < 1$ is the country's discount factor. Thus, if the banks punish the country for two periods before obtaining a settlement of x_3 , the large banks' payoff from the entire play is $-[c(p_1) + \delta_b c(p_2)] + \delta_b^2 x_3$, and the country's is $-(p_1 + \delta_c p_2 + \delta_c^2 x_3)$.

We are interested in examining the subgame-perfect equilibria of this game. By imposing this refinement of Nash equilibria, we are ruling out those equilibria based on non-credible threats. That is, we are eliminating equilibria that possess the characteristics that in some subgame a player would not actually find the sequence of actions dictated by its strategy to be a best response to the other player's strategy in that same subgame. More technically, the strategies of all the players form a subgame-perfect equilibrium of the game if they form a Nash equilibrium of the game and if, in addition, they induce equilibria on all subgames of the game.

As shown in Fernandez (1990), the type of game described above has many subgame-perfect equilibria, including some inefficient ones. One efficient equilibria, for example, has the country never repaying any part of its debt and the banks never punishing the country for this behavior. To see why this is an equilibrium, note that if the banks never threaten to punish, the country never has an incentive to repay. Any deviation by the bank, that is, any positive level of punishment, will simply be ignored by the country (although it is costly for the latter) since in the following period the country's best response will still be not to repay given its expectation of no future punishments in response to this behavior.

We will concentrate here solely on the subgame-perfect equilibrium most favorable to the banks. Consider the following pair of strategies. In the first period the large bank makes an offer \bar{x} where⁵

$$\bar{x} = \frac{\bar{p}}{1 - \delta_b \delta_c} \quad (3)$$

If this offer is rejected, the banks punish the country by an amount

$$\bar{p} = \frac{c(\bar{p})[1 - \delta_b \delta_c]}{\alpha \delta_b^2} \quad (4)$$

In every even period, if in all preceding odd periods the bank has punished by the amount \bar{p} the country's rejection of its offer, then the bank accepts any offer greater or equal to \bar{y} and rejects any offer strictly smaller than \bar{y} , where

$$\bar{y} = \frac{\delta_b \bar{p}}{1 - \delta_b \delta_c} \quad (5)$$

If, however, in some preceding odd period, p_t differed from \bar{p} , then the bank accepts any offer $y \geq 0$.

⁵We are assuming that we are in a debt crisis situation, i.e. $D > \bar{x}$, so that even in the most favorable equilibrium for the banks the country does not repay its entire debt. It is not difficult to construct a larger game, modeling the initial loan decision, such that there is uncertainty prior to the making of the loan (say, as to the $c(p)$ function) so that $D > \bar{x}$ is the result of an unfavorable shock to the bank's cost function.

In every odd period, subject to prior compliance with the odd-period punishment behavior described above, the bank offers \bar{x} . Once again, any prior deviation from the odd-period punishment behavior implies that in all subsequent even periods the bank offers $x=0$, i.e. complete forgiveness of the debt. Note that the bank never punishes the country on even periods and that \bar{p} is a function of α and so, therefore, are $\bar{x}=\bar{x}(\alpha)$ and $\bar{y}=\bar{y}(\alpha)$.

The country's strategy in the first period is to accept any offer $x \leq \bar{x}$. In every even period, if in all preceding odd periods the bank has punished the country by an amount \bar{p} , the country offers $y=\bar{y}$. If in some preceding odd period the punishment has been of a different magnitude, the country offers $y=0$. In every odd period, subject to the bank's prior compliance with the odd-period punishment rule, the country accepts any offer of $x \leq \bar{x}$ and rejects any offer strictly greater than \bar{x} . Once again, any deviation by the bank from this behavior implies that in all subsequent even periods the country rejects any offer strictly greater than zero and accepts $x=0$.

It is not difficult to check that this is a pair of subgame-perfect-equilibrium strategies. The play of these strategies has the bank making an offer of \bar{x} in the first period which the country accepts. Since agreement is reached in the first period without any punishments actually inflicted, this is an efficient equilibrium.⁶

To understand how subgame perfection imposes restrictions on players' strategies, note that what the bank might wish to do is to threaten to severely punish the country by an amount, say, of \bar{p} , unless the latter repays

⁶A proof that this strategy yields the large bank its greatest payoff is in Fernandez (1990).

its entire debt. If the country were to "believe" this threat, it would repay the debt in its entirety as long as the discounted (absolute) value of being punished forever (every odd period from now till infinity) were greater than the value of the debt, i.e. $\bar{p}(1-\delta_c)^{-1} \geq D$. Let us examine, however, the subgame in which the country rejects this offer. The bank's payoff from doing so would at most be $-c(\bar{p}) + \alpha\delta_b D$. If this payoff were negative, however, the bank's strategy would not be subgame perfect since it could always choose not to impose the punishment and obtain a payoff no smaller than zero. Thus, in the odd-period punishment strategy the punishment level can be no greater than the p that satisfies

$$-c(p) + \alpha\delta_b y = 0 \quad (6)$$

where $y = \delta_b p(1-\delta_b\delta_c)^{-1}$. Using this restriction to solve for \bar{p} results in (4).

Lemma 1: The amount of its debt that a country will repay and, therefore, the value of a share of a country's debt in the equilibrium outcome generated by the strategies that yield the large bank its greatest payoff (i.e. the strategies described above) is an increasing function of the share of the debt held by the large banks.

Proof: Use of the implicit function rule on (6) yields

$d\bar{p}/d\alpha = -\delta_b^2 / [\alpha\delta_b - (1-\delta_b\delta_c)c'(p)]$. Recalling that $c(p)$ is a convex function and evaluating the denominator at (6) yields $d\bar{p}/d\alpha > 0$. By (3), \bar{x} is an increasing function of \bar{p} . Thus, as α increases, the level of punishment that is credible increases and with it the large bank's payoff and the value of a share of debt. ||

Lemma 1 establishes that as the degree of concentration of a country's debt in the hands of the large bank increases, so does the amount of debt that will be repaid. The intuition behind this result is straightforward: as the degree of concentration increases, the payment received by the large bank for a given punishment level increases accordingly. This means that the large bank can credibly increase its punishment threat (and thus total repayment) since its ability to obtain a greater share of any payment allows it to credibly withstand a greater cost of punishment.

3. A Model of the Secondary Debt Market

If the value of a share of a country's debt is an increasing function of the proportion of its debt that is owned by the large banks, won't the latter attempt to buy up the debt of the small banks on the secondary debt market? The answer to this question is far from trivial and will depend on how the secondary market is modeled. A natural extension of the model discussed above to include a secondary market would be to allow bidding between large and small banks in the secondary market to alternate periodically (or be simultaneous) with bargaining between the large banks and the country. Unfortunately, this is an extremely complex game to solve since we have now introduced a state variable, namely the fraction of the country's debt owned by the large banks, into the bargaining game between debtor and creditor.

As an alternative, we somewhat simplify the bargaining model between the large bank and the country and allow the secondary market to function solely prior to any bargaining between these two. While the latter is, admittedly, not a realistic depiction of the functioning of the secondary debt market, it is one of the few formulations of this problem that we have been able to solve

and it allows us to bring out clearly the intuition as to why one would not necessarily expect the large banks to end up owning the entire stock of debt. We also modify our previous specification of the punishment function. Note that, as previously formulated, although punishment of the country is costly and thereby limits the level of threat that is credible, no costs are actually borne by the large bank in equilibrium. Hence, if the large bank initially owned a proportion α_0 of the debt and bought the outstanding debt at the fair price of $\bar{x}(\alpha-1)/D$ per share, it would make a positive profit since it would pay the small banks $(1-\alpha_0)\bar{x}(\alpha-1)$ but obtain a revenue of $\bar{x}(\alpha-1)$, yielding it a net gain of $\alpha_0\bar{x}(\alpha-1)$. In our new formulation of the problem, the essential difference is the introduction of a cost that must be borne by the large bank in equilibrium. The bank is now able, in each period, to punish costlessly the defaulting country. It must, however, bear instead a once-and-for-all upfront cost $L(p)$. $L(p)$ is assumed to be an increasing, continuous, convex function of the periodic punishment level p chosen by the large bank with $L(0)=0$, $L'(0)=0$ and $L'(\infty)=\infty$. The bank cannot choose a periodic punishment level greater than the p specified by $L(p)$. This cost can be thought of as lobbying costs and (perhaps partial) compensation to those domestic parties whose interests would be damaged if the large bank (and perhaps also the government of the creditor's country) were to actually penalize the debtor. Once again, these costs are assumed to be incurred solely by the large bank.

Let us first turn to solving for the best (for the large bank) subgame-perfect equilibrium of the new bargaining game between the large bank and the debtor country. It is not difficult to show that, given a chosen periodic punishment level of p , the bargaining game has a unique subgame-perfect equilibrium in which the country repays:

$$x = \frac{p}{1 - \delta_b \delta_c} \quad (7)$$

in the first round of negotiation.

The problem, therefore, facing the large bank is to choose an optimal level of p . This is given by the solution to the following maximization problem:

$$\begin{array}{ll} \text{Max} & \alpha \bar{x} - L(p) \\ & p \end{array} \quad (8)$$

yielding the first order condition:

$$L' = \frac{\alpha}{1 - \delta_b \delta_c} \quad (9)$$

which implicitly defines an optimal $\bar{p}(\alpha)$ and therefore, using (7), an $\bar{x}(\alpha) = \bar{p}(\alpha)(1 - \delta_b \delta_c)^{-1}$. Differentiation of (9) yields $\partial \bar{p} / \partial \alpha > 0$, so that although subgame perfection doesn't play the same role here as in the previous bargaining model (where it limited the level of the threat that would be found credible), the level of punishment that the large bank will choose to inflict on the country is nonetheless an increasing function of the share of the debt that it owns (as a result of the upfront costs that it incurs).

We now return to the secondary market problem. The structure of this game is as follows. In each period in which the secondary market functions,

the large bank makes a series of offers (z_i, d_i) establishing the price per share, z_i , that it is willing to pay for up to d_i shares of debt owned by small bank i . Note that each bank may receive more than one price-quantity offer, i.e. (z_i, d_i) can be a vector of prices and quantities, and that a small bank can choose to tender less than d_i .⁷ Let $d_i \leq d_i$ be the quantity of debt actually tendered by small bank i at the price z_i . Thus $z_i d_i$ is the revenue received by small bank i when it sells d_i shares at price z_i per share. Each small bank is able to accept (or partially accept) or reject any of its offers. At the end of each period t the large bank, now owning a proportion of the country's debt α_t , can choose whether to end its attempts to purchase debt on the secondary market by entering into negotiations with the country or to continue its presence in the secondary market for an additional period. Whenever it enters into negotiations with the country then, by Lemma 1, an agreement between the two will be reached in that same period. Thus, if at the end of period \hat{t} the bank decides to enter into negotiations with the country, its payoff from this play is

$$- \sum_{t=1}^{\hat{t}} \sum_i \delta_b^{t-1} d_{it} z_{it} + \delta_b^{\hat{t}-1} \alpha_{\hat{t}} x(\alpha_{\hat{t}}) \quad (10)$$

the i^{th} small bank's payoff is

⁷Note that in this fashion we preclude the possibility of the large bank making a small bank a strict take-it-or-leave-it offer.

$$\sum_{t=1}^{\bar{t}} \delta_b^{t-1} d_{it} z_{it} + \delta_b^{\bar{t}-1} (D_i - \sum_{t=1}^{\bar{t}} d_{it}) D^{-1} x(\alpha_{\bar{t}}) \quad (11)$$

where D_i is the quantity of the country's debt initially owned by small bank i and $\alpha_{\bar{t}} = \alpha_0 + (\sum_i \sum_t d_{it}) D^{-1}$. (Note that both the small and large banks have the same discount factor δ_b .)

We first consider the case in which the banks have only one period in which to trade in the secondary market prior to bargaining commencing between the large bank and the country. Notice that, in equilibrium, no trade can take place for a price less than $\bar{x}(\alpha_1)/D$ per share, where α_1 is the proportion of the debt owned by the large bank at the end of period one. To see why, let $z_j < \bar{x}(\alpha_1)/D$ be the price per share received by bank j for d_j shares. Then, by continuity of $\bar{p}(\alpha)$, it is always possible to find an $\epsilon > 0$ such that $(\epsilon/D) \bar{x}(\alpha_1 - \epsilon D^{-1}) > \epsilon z_j$ so that small bank j would be better off reducing its quantity of shares tendered by ϵ and receiving an ϵ/D share of the country's payment. Thus, if there is any trade, the minimum price at which it will take place is $\bar{x}(\alpha_1)/D$ per share. This enables us to establish the following Lemma.

Lemma 2: Given the subgame-perfect equilibrium to the creditor-debtor bargaining game described above, in equilibrium no trade will take place in the secondary debt market. The game between the large bank, the small banks, and the country ends in the first period with an agreement between the large banks and the country of $\bar{x}(\alpha_0)$ where α_0 is the large bank's initial share of the debt.

Proof: By the preceding discussion, if any trade between large and small banks takes place it does so at a minimum price per share of $\bar{x}(\alpha_1)/D$. Thus, assuming that the large bank can choose to buy Δ shares at the price of

$\bar{x}(\alpha_0 + \Delta/D)/D$ per share (the best possible scenario for the large bank), we can look at the following optimization problem for the large bank:

$$\text{Max}_{\Delta} \quad \alpha_0 \bar{x}(\alpha_0 + \frac{\Delta}{D}) - L(\bar{p}(\alpha_0 + \frac{\Delta}{D})) \quad (12)$$

By (8) and (9), the maximum is achieved at $\Delta=0$. Since the large bank always has the option of buying zero debt and obtaining this payoff, there will be no trade between large and small banks in the secondary debt market. ||

Let us now consider a T period version of this same game. The large bank now has the option, in each period except the Tth, of continuing to trade on the secondary market for an additional period or stopping the game by entering into negotiations with the country. This means that a small bank can no longer rely, when it rejects a price offer, on immediately obtaining its share of the country's payment. The large bank can choose to attempt to increase its share the following period and thus, by delaying an agreement with the country, decrease the small bank's payoff. It is not difficult to show, however, that the zero trade result is maintained.

Lemma 3: Identical to Lemma 2.

Proof: Consider a game that has continued to period T. In that period, by Lemma 2, there will be no trade. Consequently, the maximum length of the game is to period T-1 since the large bank does not gain by delaying that period. In period T-1, however, no small bank will accept a price per share smaller than $\bar{x}(\alpha_{T-1})/D$ since the threat of delaying for an additional period is not credible. But by (12), buying all additional debt at the price

$\bar{x}(\alpha_{T-1})/D$ makes the large bank worse off than not buying any debt at all.

Thus, no trade will occur in this period either. Continuing this logic by backward induction establishes that the threat of continuing to trade for any number of additional periods does not enable the large bank to obtain price concessions from any small bank since this threat is not credible.

Consequently, the game will end in the first period with zero trade and an agreement of $\bar{x}(\alpha_0)$ between the country and the large bank.||

This section has established that there is no reason to believe that, simply because the value of the debt increases the more concentrated its ownership becomes, all the debt will end up in the hands of the large bank. The free-rider problem is also endemic to this scenario. While each small bank would be better off if another small bank sold some of its debt to the large bank or if all small banks coordinated and sold part (or even all) of their debt to the large bank, the fact that each small bank has the incentive to hold out implies that in equilibrium no debt will be sold.⁸

4. Empirical Issues

An implication of the theoretical model developed in this paper is that the increased concentration of a country's debt in the hands of large banks has a positive effect on the secondary market price of that country's debt. Our purpose in this section is to provide an empirical analysis of secondary market prices so as to investigate the presence of the relation posited by the

⁸In reality, the concentration of debt has increased over time, but this can also be due to renegotiated (coordinated) deals among banks and countries. In any case, concentration has not increased to the extent of reaching a corner solution.

model. Nevertheless, although our empirical finding is in accordance with our theoretical result, our empirical analysis is not a test of the model developed previously. To put it another way, our theoretical model, which is in accordance with the stylized facts, is one plausible explanation of our empirical finding.

In most empirical studies of secondary market prices, the occurrence of trade in the secondary market, as well as the magnitude of secondary market prices (or discounts) is investigated only as a function of various country characteristics. These country characteristics are economic variables, such as debt-to-exports ratio and real per capita GNP, that presumably indicate a country's repayment prospects and events of non-payments, rescheduling agreements (Berg and Sachs (1989), Cohen (1988), Hajivassiliou (1988), Huizinga (1989), Sachs and Huizinga (1987), and Purcell and Orlanski (1988)). Although there is not a unique set of variables derived from a specific theoretical specification, there is, by now, a large body of empirical studies of developing country debt that has employed economic characteristics of borrowers.⁹ Such variables have been included, for example, in studies that attempt to predict the occurrence of repayments difficulties, and in studies that investigate credit terms (for a review see Eaton and Taylor (1986); recent studies include Ozler (1990a,b)). The relation between non-payment events and lender banks' stock market values have been investigated in Ozler (1989).

⁹Incorporation of political factors to such studies has been limited. An exception is Ozler and Tabellini (1990), where the authors employ measures of political instability among the determinants of the level of debt accumulation.

An exception to using only country characteristics in studying secondary market prices is Ozler and Huizinga (1990). That study focuses on the regulatory structure in a lender country and investigates how the presence of deposit insurance influences the secondary market price formation. Bank exposure distribution and capital aggregates are considered in the empirical investigation.¹⁰

In this paper, we introduce yet another significant dimension to the investigation of secondary market prices--one that characterizes the lenders themselves. We examine the concentration of debt in the hands of large banks relative to small banks. In what follows, we first describe an empirical model that will be used for the analysis of secondary market prices. The model described is a Tobit model. Second, we present a cursory investigation of the data and discuss how debt concentration is measured. Our basic measure of debt concentration is the ratio of the exposure of the nine largest U.S. banks to the exposure of U.S. banks that are not in the largest 24 (largeness is defined by asset size). Finally, results of our estimation are presented, and the primary finding that increased debt concentration has a negative (positive) impact on secondary market discounts (prices) is shown to be robust to alternative empirical specifications.

4.1 Empirical Specification

The trading of loans at a discount in the secondary market has taken place only for some of the indebted countries. Define T^* as follows (for convenience, time and country indicators are omitted):

¹⁰Bank characteristics are also found to be significant determinants of commercial bank behavior when these are confronted with a menu of options (see Demirguc-Kunt and Diwan (1990)).

$$T^* = \beta\phi + u_1 \quad (13)$$

where T^* = a latent variable such that, if $T^* > 0$ we observe trading at a discount in the secondary market, but if $T^* \leq 0$ we do not observe trading at a discount in the secondary market,

ϕ = variables that determine the occurrence of trading in the secondary market,

u_1 = normally distributed error term with standard error σ_1 .

As will be discussed in more detail in the data section, variables in ϕ measure the creditworthiness indicators of countries as well as the extent of their private debt.

The magnitude of discounts is determined as described below:

$$D^* = \gamma\phi' + u_2 \quad (14)$$

where D^* = discount in the secondary market. Discount is defined as $(1 - \text{price})$, where price is the secondary market price of \$1 of debt.

ϕ' = in addition to the variables in ϕ , a measure of the concentration of a country's debt in the hands of large U.S. banks.

u_2 = normally distributed random error term with a standard error σ_2 .

However, we observe positive discounts only when $T^* > 0$. Since no discounts are recorded for those countries whose debt is not traded in the secondary market, their debt appears to be at par. Accordingly, the observed discounts would be described as follows:

$$\begin{aligned} D &= D^* \text{ if } T^* > 0, \\ D &= 0 \quad \text{otherwise.} \end{aligned} \quad (15)$$

The econometric model described with equations (13-15) is a Tobit model (Tobin 1958) (type two Tobit model according to the classification of Amemiya (1984)). The standard Tobit model is a special case of the model where $T^*=D^*$.

It is well known that ordinary least squares estimation method is not the appropriate one for the type of econometric model considered. The parameter estimates are known to be biased and inconsistent if equation (14) is estimated using ordinary least squares over the observations with positive discounts. Alternatively, one may conduct the estimation by employing ordinary least squares over all the observations by assigning zeros to those countries for which positive discounts are not recorded. This approach implies that if the debt of those countries were traded, the secondary market price would be zero, which obviously is incorrect. Accordingly, we employ a censored regression estimation technique as discussed next.

It has been shown that Heckman's two-step estimator (Heckman (1976)) can be used in this type of model (Amemiya (1984)) and that it yields consistent parameter estimates. According to this method, one first estimates the probit model described in equation (13) using maximum-likelihood procedure and obtains the inverse Mills' ratio (or the hazard rate).¹¹ The discounts then are estimated according to the following second stage equation by employing only the observations in the sample with positive recorded discounts:

$$D = \gamma\phi' + \gamma_1\lambda + \varepsilon_2 \quad \text{for } T^* > 0 \quad (16)$$

¹¹From the estimation of (13) one obtains ω and Ω , where they are the density and distribution functions of the standard normal evaluated at $(\beta\phi/\sigma_1)$ respectively. The ratio ω/Ω is the hazard rate.

where λ = inverse of the Mills' ratio (hazard rate),

ϵ_2 = error term with mean zero.¹²

Equation (16) is estimated after replacing λ with its estimated value from equation (13), and using ordinary least squares method. The problem with this approach is that the asymptotic variance-covariance matrix of the parameters obtained in the second stage is not consistent.¹³ It has been pointed out by Lee (1982), however, that consistent estimates of the variance-covariance matrix can be obtained by applying an estimator similar to the heteroskedasticity consistent estimator developed by White (1980). Accordingly, in this paper we use Heckman's two-step estimation method and follow Lee (1982).¹⁴

4.2 A Cursory Inspection of the Data

Equations (13) and (16) above will be used to investigate the relation between secondary market discounts and debt concentration. In this section we discuss the variables that enter ϕ of equation (13) and ϕ' of (16), as well as characteristics of our sample. In ϕ we include country characteristics that are relevant for repayment prospects and the extent of private indebtedness of

¹²Variance of ϵ_2 is given by eq. (89), Amemiya (1984), p. 32.

¹³Heckman's method does not require the joint normality of D^* and T^* . The detailed discussion of the method summarized here and the underlying assumptions are in Amemiya p. 13 and pp. 32-33.

¹⁴It should be noted that the identifying variable in the estimation of equations (13) and (16) is a measure of debt concentration. Our theoretical model takes as given the existence of a secondary market and therefore does not address the question as to whether debt concentration should be included in (13). As long as all the debt is not owned solely by one large bank, however, it is difficult to see why a greater concentration would lead to that debt not being traded.

a country. ϕ' , in addition to the variables in ϕ , primarily includes a measure of concentration of a country's debt. Some specifications include in ϕ' additional creditor country factors, such as the exposure distribution of banks, so as to ensure the robustness of our results.

To control for characteristics of borrower countries we employ variables similar to those employed in previous studies. These variables are: debt-to-exports ratio, reserves-to-imports ratio, real GNP per capita, lagged-value-of-investment-to-GNP ratio, rate of inflation, debt-to-GNP ratio, imports-to-GNP ratio, and reserves-to-GNP ratio. In addition to these standard indicators, some structural variables have also been considered. These include the share of agriculture in GDP and a measure of income distribution. A lower agricultural base and unequal income distribution have both been argued to contribute to political instability and therefore to a less favorable environment for timely repayment (Berg and Sach (1989)).

A cursory look at the data suggests that the debt of countries with bad repayment prospects is more likely to be traded at a discount in the secondary market. In Table 1 the means and standard errors of the repayment indicators for the countries in our sample are presented. Our data contains information on 43 developing countries, based on data availability, for the period of 1986-88. In this sample the debt of 23 countries was traded at a discount. Overall, the repayment indicators appear worse for these 23 countries. Furthermore, almost all of the countries in this group have had rescheduling agreements with their creditor banks, in contrast to the remaining group with almost no reschedulings.

Table 1 also indicates that those countries with debts that are traded at a discount have larger debt outstanding to private creditors. A closer

inspection of this variable for countries that are not in the traded group is instructive. In this group countries that might be judged to have good repayment prospects have larger outstanding debt to private creditors: near 16 billion 1986 U.S. dollars for Korea and near 6 billion 1986 U.S. dollars for Greece. In contrast, countries with relatively bad repayment prospects, such as Ethiopia, and Trinidad and Tobago, also appear in this group. Debt to private creditors are .08 billion 1986 U.S. dollars, and .19 billion 1986 U.S. dollars for Ethiopia and Trinidad and Tobago respectively. One plausible explanation for these observations is that the transaction costs incurred in trading private debt on the secondary market prevents trading for countries with a small amount of private debt.

Table 2 presents some summary information concerning the secondary market discounts for the 23 countries whose debt was traded at a discount in the market over the 1986-88 period. The discounts presented in this table are calculated using bid prices. The mean discount for all countries over the period 1986-88 is 52.27 (with a standard deviation of 25.56).

The variable of interest is the degree of concentration of debt in the hands of the large international banks relative to small banks. The model suggests that we incorporate information on all banks that have outstanding loans to a country. In our empirical analysis, however, we will be restricted to data for U.S. banks only, since bank exposure data for individual countries are available only for U.S. banks in a systematic way. Since U.S banks have historically been the major players in the market, however, one may argue that not having other countries' banks may not be a major defect.

Another issue raised in creating a measure of concentration across countries is how the large banks should be selected. Should the set of large

banks be the same for each country or should, for each country, a number of banks with the highest exposure to that country be selected? Since our theoretical model does not incorporate differences among large banks, there is not a clear theoretical argument for choosing one strategy over the other. The nature of the available data, however, only permits us to look at a constant set of large banks. One may argue, in any case, that choosing the same set of the largest money center banks, independently of particular country exposure, is the more sensible strategy. The large money center banks have been unfailingly the most important players in making these loans and most likely are the banks with the greatest volume of business, in addition to debt, with the debtor countries. In comparison with the smaller banks, the large banks have greater exposure overall to all foreign borrowers. This also leads us to believe that they are the ones that would be more likely to lobby for the imposition of penalties on defaulting countries.

The exposure data that we use to compute debt concentration is compiled by the Federal Reserve Board. In this data banks are categorized as the largest nine, the next largest 15, and remaining U.S. banks. Largeness, in this data, is measured by the asset size of the banks. Accordingly, one measure that can be created using this data is the exposure of the largest nine U.S. banks to a country scaled by the exposure of the U.S. banks that are not in the largest 24 banks to that country (from here on, variable name is *con1*). For the countries in our sample we present the mean and the standard deviation for this variable on a country basis in Table 2.¹⁵ The total sample

¹⁵*Con1* was computed as 174 and 30 for Zambia and Malawi respectively. These countries were excluded from the analysis not only because these numbers are extraordinarily high relative to the sample mean, but also they show very high volatility between quarters suggesting deficiency in the data.

mean is 5.08 with a standard deviation of 2.30. It also appears that borrowers with high discounts also have low levels of concentration. The partial correlation coefficient between discounts and concentration is significantly different from zero and its magnitude is $-.22$, supporting the view that discounts (prices) and the concentration of debt in the hands of largest U.S. banks are negatively (positively) correlated.

An alternative measure of concentration is calculated by scaling the exposure of largest nine U.S. banks to the total outstanding private debt of a country (con2). The reason for creating this variable is to attempt to control for the presence of smaller banks from countries other than the U.S. in negotiations. The means and standard deviations on a country basis are presented in Table 2.

Two other issues require care in this investigation. First, since it has been demonstrated that exposure of large banks to countries is negatively correlated with secondary market prices (see Ozler and Huizinga (1990)), it is important for us to show that concentration is not a mere proxy for exposure. As can be seen in Table 2, countries to which the large U.S. banks have high exposure trade at rather large discounts, in contrast to the larger borrowers. Cursory evidence suggests that this should not be a source of concern: The partial correlation between concentration (con1) and exposure, however, is small ($.004$) and not statistically significant. Second, it should be noted that the secondary market spreads (calculated as the percentage differences between the offer and bid prices quoted in the secondary market) are large for some low concentration countries. This observation suggests that an investigation of secondary market prices based on solely the bid prices may be misleading.

4.3 Estimation Results

In this section we present results from the estimations of the equations described in the previous section: the probit specification for the occurrence of trading in the secondary market as in equation (13), and the secondary market discounts specified in (16). The primary result of our empirical investigation is that the discount in the secondary market decreases with increased debt concentration.

In order to investigate the robustness of these results we attempted a number of alternative specifications in the estimation of the two equations. Three issues require attention: First, it is important to establish that the results are not a consequence of a particular choice of economic indicators as measures of country risk among the potential ones. In order to address the first potential problem we employed alternative specifications of country characteristics. Second, the results should not be contaminated by specific market characteristics such as the size of the spread between the bid and ask prices. To address the second source of concern, we calculated the discounts as averages of bid and ask prices in the secondary markets. Third, since it has been demonstrated that creditor country factors such as the exposure distribution of banks and bank capital aggregate are important in secondary market price determination, it is important to demonstrate in our estimations that inclusion of these variables does not change the qualitative conclusions concerning the concentration variable.

In Tables 3-6 we present estimation results for two basic empirical models with alternative specifications. We next describe the differences between these models and various specifications: (In addition to the

variables that are described below, each specification employs region specific and quarterly dummy variables.) Model 1 (presented in Tables 3-4) incorporates the following basic variables: stock of debt to private creditors, debt-to-exports, reserves-to-imports ratios, real GNP per capita, and the inflation rate. Alternative specifications of this model include investment-to-GNP ratio, a measure of income distribution, and share of agriculture in GDP, and a measure of bank exposure and bank capital. Model 2 (presented in Tables 5-6) replaces debt-to-exports and reserves-to-imports by debt-to-GNP, imports-to-GNP, and reserves-to-GNP. Alternative specifications of Model 2 are structured analogous to the alternatives of Model 1.

Table 3 primarily indicates that bank concentration is negatively related to the discounts. The variable is found to be a significant determinant of secondary market discounts as indicated by large "t" values. The result is robust to using the alternative measures of the concentration variable and to the inclusion of exposure and capital variables. The estimations suggest that higher debt-to-exports ratio, higher inflation, lower GNP per capita, and lower reserves-to-imports ratio increase the likelihood that the debt of a country is traded at a discount in the secondary market. (The estimated probabilities of trading are large for all countries for which there is trading and drop dramatically for the remaining countries.) In the same table we also observe that variables that contribute towards the occurrence of trade increase the magnitude of discounts; the variables that decrease the likelihood of trading decrease the magnitude of discounts. An exception is the amount of debt outstanding to private creditors. An increase in this variable increases the likelihood of trading, but decreases the discounts. The income distribution variable is incorporated only in the discount equation

since it was not possible to estimate the probit equation when this variable is incorporated. The sign of the income distribution variable indicates that the debt of countries with historically worse income distribution is traded at lower discounts in the secondary market (this is in contrast to the finding of Berg and Sachs (1988)).

Table 4 is a further variation of Model 1. The basic finding that the concentration of debt is negatively related to the magnitude of the discounts continues to hold. Investment-to-GNP ratio and the share of the agriculture sector in GDP are incorporated in Model 1, both in the estimation of the probit equation and in second stage equation. An increase in the magnitude of either of the variables is found to decrease the probability of trading in the secondary market. Share of agriculture is also found to decrease the magnitude of discounts.

Tables 5 and 6 are expositied the same way as Tables 3 and 4, except that the basic underlying structure is that of Model 2. The main finding continued to hold: debt concentration is found to have a negative impact on the magnitude of discounts in the secondary market and this finding is robust to alternative definitions of the concentration variable as well as to the incorporation of bank exposure and capital variables. In addition, these tables indicate that GNP per capita and inflation rates continue to hold the same signs as in Tables 3-4 and they remain important determinants of trading. Higher reserves-to-GNP, higher imports-to-GNP, higher debt-service-payments-to-exports ratio all reduce the likelihood of trading. Estimated probabilities from all these specifications also seem reasonable in that actual no-trading countries are assigned quite low probabilities of being traded, in contrast to the remaining countries. As in Model 1, worse income

distribution is found to contribute to increased probability of trading but it appears to reduce the discounts.

Overall, the signs of repayment indicators are consistent with their expected signs: high debt-to-exports ratio or a high ratio of debt-to-GNP makes non-payment more likely. The negative sign of reserves-to-GNP ratio suggest that it is an indicator of the level of international liquidity of the borrower. A high ratio of imports to GNP may make the borrower more creditworthy since the borrower may become more vulnerable to trade embargoes. High inflation appears to be an indicator of a larger probability of balance of payments crisis. Finally, countries with high GNP per capita are found to be more creditworthy.

It is important to note that our finding are not a consequence of a few extraordinarily influential observations. Specifically, the magnitude of spreads between the bid and ask prices of the secondary market for some countries may raise this concern. As indicated in Table 2, the spreads for Bolivia, Liberia, Peru and Sudan are quite large (18, 37, 18, 61 percent respectively). Our findings, however, are robust to the exclusion of these countries from the sample.

To summarize, the finding that emerges from these tables is that the degree to which a country's debt is concentrated is an important determinant of the magnitude of its secondary market discount. In particular, a higher debt concentration leads to a lower (higher) secondary market discount (price). How important is the magnitude of this effect? Evaluated at the mean of our sample (near 52 and 5 for discount and concentration (con1) respectively), doubling the concentration would yield a change in the discounts in range of 7 cents to 30 cents on the dollar. The range is a

function of the alternative magnitudes (in the range $-.12$ to $-.59$) for the estimated parameter value for $conl$ in various specifications. Most specifications yield parameter values for the variable $conl$ near $(-.25)$, a magnitude that would indicate that a doubling of concentration from the sample mean of 5 to 10 would cause a 13 cent decrease in secondary market discounts.

Concluding Remarks

Evaluations, both normative and positive, of different schemes to deal with the debt crisis rely on secondary market prices as indicators of the expected value of a country's repayments. In these analyses it is often assumed, sometimes implicitly, that secondary market prices reflect only features associated with a country's economic performance. By way of contrast, in this paper we argue that certain characteristics of a country's creditors, in particular the degree of concentration of a country's debt in the hands of the largest U.S. banks, will also affect a country's repayment prospects and, hence, secondary market prices. We conduct a theoretical and empirical investigation of this issue.

In the context of a model that distinguishes between large money center banks and smaller regional banks, we show that the percentage of a country's debt held by the large banks affects the secondary market price of that country's debt: the higher the concentration of the debt, the higher the secondary market price. We also show that if debt is freely traded in the secondary market, the entire stock of debt will not eventually end up being owned by the large banks. Our empirical analysis incorporates a number of potential determinants of secondary market prices. Among these are variables that are associated with a country's economic performance, variables that can

be associated with the regulatory structure in the creditor's country, and the concentration of debt in the hands of the largest US banks. Our empirical findings indicate that concentration indeed has a positive effect on secondary market prices.

This research highlights the potential importance that characteristics other than those possessed by the debtor country can have on secondary market prices. Future investigation of the roles played by different characteristics of creditor banks may prove to contribute to the understanding and resolution of the debt crisis.

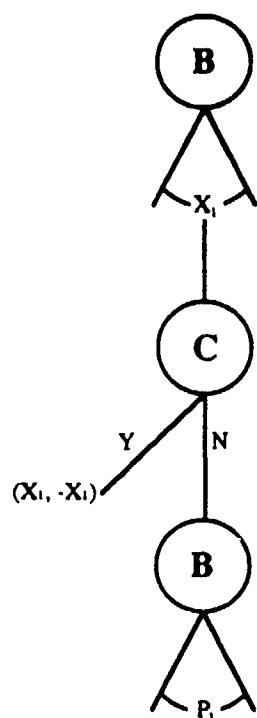
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PERIOD 1



PERIOD 2

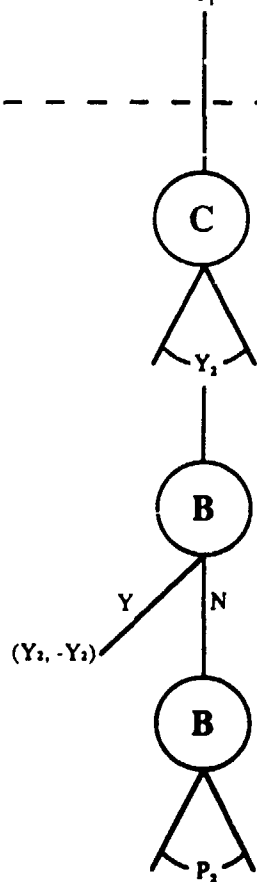


FIGURE 1

Table 1
Sample Characteristics

	For Countries Whose Assets Are: ^a			
	Traded		Not Traded	
	Mean	Standard Deviation	Mean	Standard Deviation
Debtexp	4.02	2.47	2.62	2.22
Resimp	1.20	1.00	1.03	0.74
Rgnp	1.30	0.76	2.03	2.05
Inf	0.10	0.13	0.02	0.03
Invgnp ^b	0.18	0.05	0.22	0.06
Debtgnp	0.71	0.34	0.40	0.16
Resgnp	0.22	0.18	0.39	0.64
Impgnp	0.22	0.11	0.37	0.37
Incrat ^c	0.19	0.09	0.08	0.02
Agrat	0.15	0.07	0.19	0.11
Pridebt	5.07	6.62	3.76	4.21

(Variable definitions and sources are provided below.)

Notes:

^aThe countries whose debt is traded in the secondary market are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa-Rica, Dominican Republic, Ecuador, Honduras, Ivory Coast, Jamaica, Liberia, Mexico, Morocco, Panama, Peru, Philippines, Sudan, Turkey, Uruguay, Venezuela, Yugoslavia, Zaire.

The remaining countries in our sample are: Cameroon, Egypt, El Salvador, Ethiopia, Greece, Hungary, India, Indonesia, Israel, Jordan, Kenya, Korea, Pakistan, Paraguay, Portugal, Singapore, Sri Lanka, Thailand, Trinidad and Tobago, Tunisia.

^bThis variable is not available for Argentina, Mexico, Sudan, Turkey, and Zaire.

^cThese series are obtained from Sachs and Berg (1988) and are not available for Bolivia, Cameroon, Dominican-Republic, El Salvador, Ethiopia, Greece, Honduras, Jamaica, Jordan, Liberia, Pakistan, Sri Lanka, Sudan, Venezuela, Zaire.

Table 1 (Continued)

Variable Definitions and Sources:

(Variables that are not noted as quarterly are measured as annually.)

Detexp	: Ratio of total public outstanding debt to exports (exports are quarterly)
Resimp	: Ratio of total reserves to imports (both quarterly)
Rgnp	: GNP per capita in thousands of 1986 U.S. dollars
Inf	: Rate of inflation (quarterly)
Invgnp	: Ratio of domestic investment to GNP
Detgnp	: Total public debt to GNP ratio
Impgnp	: Imports to GNP ratio (imports are quarterly)
Resgnp	: Reserves to GNP ratio (reserves are quarterly)
Agr	: A dummy variable indicating that a country has signed a rescheduling agreement with its bank creditors
Incrat	: A measure of income distribution, defined as the ratio of the highest income quartile to the lowest income quartile for the early 1970s. The variable is available for the cross-section of some countries.
Agrat	: Agriculture to GDP ratio averaged over the period of 1970-1981.
Pridebt	: Debt outstanding to private creditors in billions to U.S. dollars (quarterly)

Sources: International Financial Statistics (IMF), World Debt Tables (The World Bank), Sachs and Berg (1988).

Table 2

Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Argentina	53.33	18.76	7.38	1.00	0.87	2.82	6.48
Bolivia	91.32	2.01	3.04	1.01	0.05	18.32	0.04
Brazil	41.03	13.66	5.45	1.44	0.60	2.43	15.86
Chile	36.92	4.77	3.98	0.88	0.81	2.44	3.92
Columbia	23.90	10.15	5.10	0.75	0.38	2.00	1.52
Costa Rica	70.80	14.96	2.91	0.51	0.36	9.49	0.20
Dominican Republic	65.42	11.91	5.50	0.57	0.60	7.05	0.28
Ecuador	54.33	19.40	2.87	0.60	1.34	4.31	1.17
Honduras	67.29	8.42	1.74	0.75	0.11	8.46	0.05
Ivory Coast	43.95	21.64	5.84	1.30	0.09	5.57	0.28
Jamaica	59.72	4.99	6.95	1.20	0.48	9.43	0.12
Liberia	91.54	5.02	2.96	0.88	0.47	37.72	0.03
Mexico	46.73	5.11	2.68	0.42	0.63	2.38	13.29
Morocco	38.77	9.45	7.99	1.62	0.43	3.16	0.59
Panama	49.14	21.37	3.55	0.90	0.49	5.97	0.54
Peru	87.75	6.47	2.92	0.35	0.18	18.64	0.57
Philippines	40.38	8.30	8.97	1.45	0.44	3.04	3.37
Sudan	95.38	3.67	6.08	3.29	0.02	61.91	0.02
Turkey	2.53	0.65	5.52	1.05	0.15	1.47	1.15
Uruguay	36.12	4.73	8.53	0.72	0.90	2.91	0.68
Venezuela	35.96	12.33	5.96	0.24	0.52	2.15	6.14
Yugoslavia	34.97	15.91	4.14	0.45	0.17	2.46	1.24
Zaire	77.91	2.81	6.78	0.97	0.02	13.89	0.007

Notes:

- Col(1) : Average discount in the secondary market (100-bid price) over the 1986-1988 period.
- Col(2) : Standard deviation of the discounts.
- Col(3) : Exposure of top nine US banks scaled by the exposure of US banks that are not in the top 24 (Con1). The variable is computed as an average over the 1986-1988 period.
- Col(4) : Standard deviation of Con1.
- Col(5) : Exposure of top nine US banks scaled by total outstanding private debt of the country (Con3). The variable is computed as an average over the 1986-1988 period.
- Col(6) : Percentage difference between the bid and ask prices in the secondary market.
- Col(7) : The exposure of the top nine US banks in US\$ billion.

Sources: *Indicative Prices for Less Developed Country Bank Loans*, Salomon Brothers.

Country Exposure Lending Survey, Federal Reserve Board.

World Debt Tables, The World Bank.

The numbers in parentheses are "t" values.

The dependent variable in the second stage equation (eq. 16) is the logarithm of discounts. The discounts are calculated as $(100 - \text{avprice})$ where avprice is the average of bid and ask prices.

Lcon1 and Lcon2 are the logs of concentration measures con1 and con2.

Lex9 and Lk9 are the logs of top nine US bank exposure and capital respectively. Both variables are in thousands of 1986 US \$.

Not reported here are coefficients of quarterly dummies.

In Table 3 and Table 5 columns (2-4) are 2nd stage equations. They all use the specification in column (1) for the 1st stage in the respective tables.

In Table 4 and Table 6, column (2) employs column (1) and column (4) employs column (3) as first stage equations.

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Table 3

Secondary Market Prices and Concentration -- Model 1

	(1)	(2)	(3)	(4)	(5)
Lcon1		-0.26 (-4.26)		-0.21 (-3.63)	-0.59 (-4.81)
Lcon2			-0.80E-01 (-2.66)		
Lex9				-0.13 (-7.07)	
Lk9				4.06 (1.03)	
Incrat					-0.26E-01 (-4.61)
Pridebt	0.27E-06 (6.62)	-0.16E-07 (-3.34)	-0.13E-07 (-2.62)	0.56E-08 (1.04)	-0.10E-07 (-1.57)
Debtxp	0.84E-03 (2.16)	0.37E-03 (3.25)	0.26E-03 (2.10)	0.36E-03 (3.39)	0.60E-04 (0.30)
Resimp	-0.80E-02 (-6.07)	-0.85E-03 (-2.45)	-0.11E-02 (-3.16)	-0.42E-03 (-1.24)	-0.21E-02 (-3.20)
Rgnp	-0.88 (-5.19)	-0.13 (-2.26)	-0.13 (-2.35)	-0.67E-01 (-1.14)	-0.48E-01 (-0.67)
Inf	0.16 (6.42)	0.11E-01 (3.91)	0.11E-01 (3.96)	0.11E-01 (4.25)	0.13E-01 (3.79)
Latin	4.15 (9.40)	1.02 (3.71)	1.28 (4.73)	1.04 (0.27)	1.74 (4.76)
Africa	2.20 (6.31)	0.97 (3.68)	1.00 (3.83)	0.85 (3.30)	1.26 (3.84)
Constant	-1.75 (-3.32)	4.56 (9.31)	3.07 (9.86)	-5.90 (-3.62)	6.52 (10.67)
Millsinv		0.22E-02 (0.01)	0.11 (0.48)	0.16 (0.64)	0.86 (2.34)
McFadden R-Square	0.58				
% of Right Predictions	0.88				
Nobs at 1:	237				
Nobs at 0:	208				
Adjusted R-Square		0.38	0.37	0.43	0.38

Table 4

Secondary Market Prices and Concentration -- Model 1

	(1)	(2)	(3)	(4)
Lconl		-0.28 (-4.59)		-0.26 (-2.72)
Invgnp	-0.79E-01 (-4.12)	-0.45E-02 (-0.61)		
Agrat			-0.34 (-2.64)	-0.35E-01 (-5.44)
Pridebt	0.26E-06 (5.63)	-0.10E-07 (-2.03)	0.59E-06 (4.24)	-0.14E-07 (-2.62)
Debtxp	0.51E-03 (1.11)	0.21E-03 (1.17)	0.38E-03 (3.87)	0.20E-04 (0.12)
Resimp	-0.75E-02 (-5.39)	-0.11E-02 (-2.44)	-0.15E-01 (-3.87)	-0.99E-03 (-2.61)
Rgnp	-0.52 (-2.66)	-0.21 (-3.86)	-6.03 (-4.44)	-0.18 (-2.69)
Inf	0.84E-01 (2.92)	0.61E-02 (2.76)	0.51 (4.84)	0.88E-02 (3.02)
Latin	4.13 (9.25)	0.43 (2.07)	11.56 (5.06)	0.96 (3.74)
Africa	1.96 (5.04)	0.13 (0.93)	3.88 (3.80)	0.78 (2.83)
Constant	-0.11 (-0.16)	5.51 (11.35)	7.69 (2.16)	5.27 (9.90)
Millsinv		0.13 (0.80)		0.39 (1.10)
McFadden R-Square	0.57		0.83	
% of Right Predictions	0.89		0.93	
Nobs at 1:	171		174	
Nobs at 0:	196		140	
Adjusted R-Square		0.41	-	0.34

Table 5
Secondary Market Prices and Concentration -- Model 2

	(1)	(2)	(3)	(4)	(5)
Lcon1		-0.21 (-2.91)		-0.13 (-2.01)	-0.33 (-2.64)
Lcon2			-0.67E-01 (-2.06)		
Lex9				-0.12 (-5.84)	
Lk9				3.33 (4.08)	
Incrat					-0.22E-01 (-3.27)
Pridebt	0.52E-06 (5.24)	-0.18E-07 (-4.62)	-0.17E-07 (-4.10)	0.25E-08 (0.51)	-0.43E-08 (-0.60)
Debtgnp	0.17 (5.57)	0.50E-02 (2.93)	0.42E-02 (2.44)	0.31E-02 (1.79)	0.88E-02 (2.86)
Resgnp	-0.81E-01 (-3.88)	-0.39E-02 (-2.44)	-0.39E-02 (-2.44)	-0.16E-02 (-1.10)	-0.13E-01 (-3.52)
Impgnp	-0.67E-01 (-2.62)	-0.51E-02 (-1.40)	-0.45E-02 (-1.19)	-0.61E-02 (-1.75)	0.16E-01 (1.19)
Rgnp	-0.59 (-1.68)	-0.10 (-1.53)	-0.11 (-1.72)	-0.68E-01 (-1.06)	0.14E-01 (0.18)
Inf	0.45 (4.94)	0.79E-02 (3.07)	0.67E-02 (2.80)	0.64E-02 (2.84)	0.12E-01 (3.03)
Latin	5.51 (5.31)	0.68 (2.91)	0.79 (3.39)	0.68 (2.90)	1.45 (3.39)
Africa	1.26 (1.22)	0.49 (1.82)	0.46 (0.26)	0.42 (1.58)	0.54 (1.36)
Constant	-1.63 (-4.87)	4.50 (10.24)	3.45 (9.98)	-5.99 (-3.68)	4.30 (5.08)
Millsinv		-0.62 (-2.07)	-0.69 (-2.37)	-0.61 (-2.10)	0.47 (0.78)
McFadden R-Square	0.84				
% of Right Predictions	0.95			-	
Nobs at 1:	239				
Nobs at 0:	208				
Adjusted R-Square		0.42	0.42	0.46	0.37

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Table 6

Secondary Market Prices and Concentration -- Model 2

	(1)	(2)	(3)	(4)
Lconl		-0.37 (-6.48)		-0.12 (-2.21)
Invgnp	-0.37 (-3.69)	-0.15E-01 (-2.09)		
Agrat			-1.21 (-2.52)	-0.18E-01 (-2.15)
Pridebt	0.13E-05 (4.22)	-0.87E-08 (-1.87)	0.17E-05 (2.96)	-0.68E-08 (-1.11)
Debtgnp	0.30 (4.29)	0.95E-02 (4.70)	0.42 (2.67)	0.94E-02 (3.06)
Resgnp	-0.89E-01 (-2.41)	-0.47E-02 (-2.65)	-0.24 (-2.89)	-0.53E-02 (-2.14)
Impgnp	-0.95E-01 (-1.91)	-0.54E-02 (-1.43)	0.13 (1.45)	0.82E-03 (0.07)
Rgnp	-0.88 (-1.33)	-0.60E-01 (-1.14)	-16.49 (-2.67)	-0.23E-01 (-0.24)
Inf	0.79 (3.76)	0.72E-02 (3.56)	1.99 (2.91)	0.76E-02 (2.56)
Latin	10.83 (2.60)	-0.30E-01 (-0.27)	30.34 (2.97)	0.55 (2.21)
Africa	-0.81 (-0.52)	-0.37 (-3.26)	1.47 (0.67)	0.78E-01 (0.27)
Constant	-1.41 (-0.14)	6.02 (15.15)	-0.43 (-0.05)	3.78 (4.51)
Millsinv		-0.24 (-1.62)		
McFadden R-Square	0.92		0.92	
% of Right Predictions	0.98		0.98	
Nobs at 1:	173		176	
Nobs at 0:	196		140	
Adjusted R-Square		0.54		0.38

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